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REPORT OF A COMMITTEE

OF THE

Boston Society for Medical Improvement,

ON

THE ALLEGED DANGERS WHICH ACCOMPANY THE
INHALATION OF THE VAPOR

OF

SULPHURIC ETHER.

BOSTON:

DAVID CLAPP, PRINTER..... 334 WASHINGTON STREET.

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R E P O R T .

ANY one who has observed the course of events, especially the tone of journals and the published statements of late surgical writers, as Erichsen, Druitt, Hamilton and others, must have noticed a diminishing confidence in the safety of chloroform and an increasing willingness to allow the greater security of ether. Various influences have, however, prevented the disuse of the former, even by many of those in whose hands accidents have occurred, and it still remains the anæsthetic most in vogue. When the subject of chloroform first came under discussion, its dangers were commented upon, and even then freely acknowledged. It had not been two months introduced, when "a well-developed girl of 15" died from its administration for the evulsion of a toe-nail, "the process of inhalation, operation and death not having occupied more than two minutes."* Since that time, deaths from its use have repeatedly occurred. On the other hand, fatal results from ether, although still figuring in the statistics of mortality from anæsthetics, are everywhere admitted to be very infrequent. Indeed, the opinion has been expressed by various authorities, both in America and Europe, that a death really attributable to the inhalation of sulphuric ether is yet to be reported. The correctness of this opinion has, however, been repeatedly denied, and the strong conviction of the absolute safety of this agent, which exists in some localities in this country, is thought to have its foundation rather in the desire that the fact might be established than in the proof that it was so. Of course no one intends to say that a person cannot be killed by ether. The inhalation of its vapor, without a sufficient admixture of oxygen, destroys life by asphyxia. This may happen,

* Medical Gazette, Feb. 11th, 1848, p. 255.

and unfortunately has happened, but such an event cannot be laid to the anæsthetic, since, in such a case, it is the method of administration, and in no sense the ether, which causes the fatal result.

It is the purpose of this report to solve the doubt just implied with regard to the absolute safety of sulphuric ether, and to investigate the dangers of its use as compared with chloroform. In pursuance of this object, therefore, we propose, in the first place, to consider what conditions and precautions are necessary in bringing about a state of insensibility by its use, and what phenomena of etherization have an apparent or real danger.

I. The safe inhalation of ether requires proper attention—1st, to the quality of the article used; 2d, to the method of administration; 3d, to the symptoms which present themselves while the patient is under its influence.

1st. *Quality of Ether.*—Ether for inhalation should be of unquestionable purity. A large amount of inferior ether is sold which cannot readily be distinguished from that which is pure, except by its effects, although an expert, familiar with its properties, may infer something from the odor and other sensible qualities. The inferiority may be due to oxydation from bad corking, the presence of alcohol, sulphurous acid which has not been removed by thorough washing, and volatile oils. Either of these impurities may give rise to a tedious and imperfect inhalation, and the latter of them, by irritating the bronchial mucous membrane, to such coughing, struggles and resistance that the patient is finally etherized in a distressing and unsatisfactory manner. Accidents of this kind lead to a disparagement of the value and practical usefulness of ether. It is therefore an advantage for the surgeon to procure his own ether, or to use from an "original package," of the character of which he has already assured himself.

There are two brands of ether in common use in this country; viz., that manufactured by Powers & Weightman, of Philadelphia, and that by Dr. Squibb, of Brooklyn, N. Y. These are uniformly of excellent quality. The latter is remarkably anhydrous, but possesses an odor more harsh, disagreeable, and intensely ether-like than the former, and, in the opinion of those who have used it extensively, produces more choking during inhalation. This may be remedied to a certain extent by moistening the sponge from

which it is given in water, enough of which will perhaps be taken up by the ether to diminish its unpleasant effects.

Ether may be made purer by simple agitation in lime-water, allowing the water to settle, and then decanting; and this washing is, practically, and for general application, as good a method of purification as can be adopted without re-distillation.

2d. *Method of Administration.*—Ether should never be given from any inhaling apparatus. The best medium of its administration is a bell-shaped sponge, large enough to cover in the nose, mouth and chin; but it is difficult to find one of sufficient size and close enough in texture, or without such numerous apertures at the root as to admit too freely the atmospheric air. A sponge of this sort, moreover, being as expensive as rare, is seldom used outside of hospitals. A stiff towel, properly folded, may be substituted, and has the advantage of being always at hand; as it may be left behind, the surgeon does not carry away with him the annoying odor of an impregnated sponge. It is desirable that the towel should be a new one, and of pretty good size. It is to be taken just as it comes from the laundry, and not unfolded further than to display it in the dimensions of about ten inches by five; by folding down two of the corners in such a way that they shall lap over each other a little, and securing them by stout pins, a cone will be made which fits the face admirably. The thick layers of towelling will hold sufficient ether, and its texture prevent a too free dilution of the anæsthetic by the atmospheric air, provided the apex and seam of the cone are carefully and tightly closed, either by pins or the fingers. As the cone becomes collapsed by saturation, it should from time to time be opened, and kept in shape by distending it with the hand. Unless these details are attended to, and especially the closure of the apex of the cone, the induction of anæsthesia will be uncertain and protracted. In anything so porous as a towel or sponge, the difficulty is to exclude enough air; for while its adequate admission to the lungs during etherization is essential to the life of the patient, its too free entrance not only delays anæsthesia, but induces a condition of excitement, both mental and physical. The importance of excluding the air, as above stated, is a point not generally appreciated, but the necessity of it has long been known to those most accustomed to the use of ether, as shown by the “chemise” with which, in hospital practice, a too

porous sponge is often covered to expedite the etherization of a rebellious patient.

Ether should be poured lavishly on the towel or sponge, an ounce or two at a time, especially at the commencement of inhalation. Although it may be wasted, too much, so far as safety is concerned, cannot be used. A small quantity poured on hesitatingly and timidly, as is sometimes done, has the same effect as a too free dilution of the vapor with air, producing simply intoxication and its accompanying excitement without anæsthesia; whereas a large amount, though the cough and choking sensation which the greater volume of vapor produces may cause the patient to resist and struggle, is certain to bring about a satisfactory condition of insensibility.

3d. *Phenomena of Etherization.*—A strong, full-blooded man is pretty sure to resist the approaches of anæsthesia under any circumstances. This may sometimes be overcome by warning him before hand of such a possibility, and inducing him to resolve not to struggle; the last impression on his mind influences him even in his stupor. Resistance is also liable to be made by almost all patients just before complete anæsthesia takes place, but the ether rarely requires to be suspended. Occasionally the respiration becomes embarrassed during the period of excitement, partly from the struggle itself, and partly perhaps from the increased flow of saliva, which is a common phenomenon of etherization, or from the position of the tongue or head of the patient, and a condition may sometimes show itself characterized by lividity, rigidity, and convulsive motions of the extremities. These phenomena, it is an observation of Dr. H. J. Bigelow, of this city,* are in reality the tetanic symptoms which, as Dr. Brown-Sequard has shown, precede the approach of asphyxia. Although alarming to the inexperienced, the state is in fact devoid of danger, provided the ether be momentarily suspended; this being done, the refusal to breathe soon gives place to a long-drawn inspiration, and in most instances complete insensibility immediately ensues. In such a case it is interesting to observe how readily the spasm yields, and how complete is the muscular relaxation which follows the free respiration of air unmixed with ether. It should therefore be borne in mind, that when there is muscular rigidity with lividity,

* Unpublished Records of the Boston Society for Med. Improvement.

the suspension of etherization will transform this into the relaxation of anæsthesia. Persons of intemperate habits succumb to ether slowly, and with greater reluctance and more opposition than persons unused to intoxication.

The pulse should be watched by a competent person from the outset, and its failure, either in strength or frequency, lead to a more cautious use of the ether. It must, however, be remembered, that in experiments with anæsthetics upon animals, the heart has been found to be the *ultimum moriens*;* the respiratory movements, therefore, should not be forgotten or neglected, but any slowness or irregularity in their performance should at once receive attention. Dr. H. J. Bigelow has drawn attention to the distinction between the effects of anæsthesia upon the pulse of the healthy subject suddenly reduced by accident, and a similar or even stronger pulse in a person exhausted by long and grave disease. In the former case the vitality is unimpaired, and the pulse, even when hardly perceptible, rises with anæsthesia. Ether, therefore, is not to be withheld from a patient to be operated on, even in a state of collapse after severe accident, but great caution is demanded in its use with patients who are near death from chronic and exhausting disease, and who require operations.†

The best test of complete etherization is the snoring of the patient; and no operation, unless slight, should be undertaken until this symptom presents itself. The relaxation of the muscles of the extremities may occur without insensibility. The important distinction between *snoring* and *stertor* is, however, to be borne in mind. Whilst the former is caused only by the relaxation of the muscles of the palate, the latter arises from spasm of the vocal cords and partial closure of the rima glottidis, and thus becomes the immediate forerunner of the train of symptoms already referred to as indicative of partial asphyxia. Stertorous respiration demands, therefore, a brief suspension of inhalation; one or two inspirations of fresh air will, as already mentioned, almost instantly dispel the symptom.

Ether may be administered to persons of all ages, from the new-born infant to the octogenarian. There is, however, a condition prone to manifest itself with children, especially those who

* Du rôle de l'alcool et des anesthésiques dans l'organisme, Lallemand, Perrin et Duroy, Paris, 1860, p. 393.

† Unpublished Records of the Boston Society for Med. Improvement.

are weak, strumous or overgrown, which is due to its cumulative properties. It may show itself after almost any degree of etherization, and is characterized by a feeble pulse and slow respiration, not passing off with the readiness usually marking the phenomena of etherization. With young persons a cautious inhalation of five minutes will often induce an anæsthesia of half an hour, an effect wholly out of proportion to that which the same amount of ether would produce in an adult. This state is not a dangerous one, and only requires time to dissipate its symptoms. Compression of the chest will expel the fumes of ether being eliminated from the pulmonary surface, and admit the entrance of a fresh supply of oxygen to stimulate the circulation. The inhalation should therefore be suspended at short intervals with children, and but little ether given at a time. Undoubtedly it should also be used cautiously with persons, past the middle period of life, of such a general obesity or constitutional condition as may lead to the supposition of a fatty degeneration of the heart. In none of the alleged deaths from ether, however, is there any mention of valvular disease of the heart being found. Of this, then, and of any bad effect upon pulmonary affections, there need be no fear, for we see it constantly administered without detriment to persons more or less advanced in phthisis, for the common operation of fistula in ano.

Its subsequent effects are rarely disagreeable. The nausea and vomiting which follow the use of any anæsthetic may be prevented or diminished by giving it upon an empty stomach. Faintness, although a rare event, is occasionally noticed, and demands the ordinary treatment by stimulants. Headache sometimes remains for a few hours, but seldom persists into the following day. We now and then hear of delirium, debility, and the non-return of a full use of the mental faculties, as temporary accidents from the use of ether.* Such occurrences must be of extreme rarity, and probably find their explanation as much in the idiosyncrasies of patients as in the effects of the anæsthetic.

II. Having thus detailed what we conceive to be the conditions of its successful and safe administration, we undertake, in

* *Lente*, N. Y. Journ. of Med., Nov., 1856. *Clark*, do. do., Sept., 1856. *Hooker*, Boston Med. and Surg. Journ., Vol. 53, p. 231. *Humphry*, Provincial Med. and Surg. Journ., Aug. 9, 1848.

the second place, to prove that, these conditions being fulfilled, sulphuric ether is, of all anæsthetic agents, alone worthy of unlimited confidence.

Confirmation of this assertion is to be found in what we know of the use of ether in other places. It is true that thus far this has been limited to a few localities, but wherever it has been adopted the confidence and freedom with which it is administered is worthy of notice. In 1857, it was stated that for about eight years ether alone had been used in the civil or hospital practice of Lyons, in France, and that during that time the necrology of anæsthetics, so far at least as that city was concerned, had remained closed.* And here in Boston, where more ether has probably been inhaled during the last fifteen years than in any other place in the world, from the time when Dr. George Hayward performed the first capital operation under its influence (Nov. 7, 1846) down to the present day, no fatal result has ever occurred, or been heard of in the vicinity, though repeated deaths have happened from chloroform during the same period.

But to sustain the above conclusion with regard to the absolute safety of sulphuric ether, your Committee place their chief reliance upon the histories of the recorded fatal cases thought to have been caused more or less by its inhalation, and upon the result of their own efforts to obtain information of all others of the kind known to the profession any where.

With unequalled facilities to examine the literature of the subject under discussion, with all of the chief foreign and American Journals at hand, and the results of a most extensive distribution of circulars before us, no case of which we have knowledge can be cited as unquestionably and unavoidably fatal from the breathing of pure sulphuric ether.†

The following two conditions must be considered essential to any case of death fairly attributable to the inhalation of an anæsthetic agent :—

* *Revue Médicale*, 1857, p. 602.

† In an appendix to this report, every instance of alleged death, or allusion to such, caused by any form of ether, which we have been able to find, is given with all the important facts of its occurrence, or at least so far as they could be obtained. If any other cases, conclusive or not, have occurred, this Committee is not responsible for their ignorance of them, as they have used every means in their power, by notices in newspapers and Medical Journals, and by a correspondence scattered over the United States (long prior to the interruption of mail communication by the rebellion), British Possessions, West Indies, England and Europe, to collect all existing facts bearing on the subjects of their investigations.

1st, That the event should occur while the patient is actually in an anæsthetic state.

2d, That the circumstances of its occurrence should be inexplicable by any phenomena of disease or operation.

Such a death should be unavoidable by any precautions which might be adopted were the patient to be again rendered insensible under similar circumstances. It must, consequently, be sudden and unexpected in manifesting its symptoms, as well as rapid in its progress to a termination. The unmistakeable deaths following the use of chloroform have usually been almost instantaneous; out of 27 which occurred within 10 minutes, 15 took place in less than 2 minutes.* No conclusive light can be thrown on the subject by a post-mortem examination; it can only demonstrate a cause exculpating the anæsthetic, there being no pathognomonic signs of death from the use of these agents.

It is clearly unreasonable, therefore, to attribute to an anæsthetic deaths happening long after patients have recovered from its immediate and specific influence. A man is etherized for lithotomy, and dies of pneumonia a week later; or, a female, anæmic and feeble, suffering from the constitutional effects of a malignant tumor of large and rapid growth, inhales ether for the bloody or tedious operation by which it is to be removed, and dies twenty-eight hours afterwards without rallying. Events of this description are not so infrequent where no anæsthetic has been used as to require any other explanation than such as may be found in the operation or disease itself, and are obviously liable to occur from accidental causes under any circumstances. Yet this is the character of a large proportion of the facts cited by writers as evidence to prove the occasional occurrence of fatal results from the inhalation of ether.

Of the whole number of alleged deaths from sulphuric ether (41) which has been collected by your Committee, 16 survived the inhalation from 3 to 16 days, and 8 from 3 to 50 hours. In all of these death occurred after the peculiar primary effects of its use had subsided, from a secondary set of symptoms, which were either simply coincident, or else such as are well known frequently to terminate in death when no anæsthetic has been used, and which,

* British Med. Journal, Feb. 21, 1857.

moreover, never show themselves in cases of inhalation for slight and trivial operations where the primary effects of ether have been just as well marked as in the severer operations after which they were alone noticed. Of the six cases in which death occurred in less than 24 hours, three, viz., Nos. 3, 8 and 12, have been almost universally set aside as inconclusive; two, Nos. 15 and 21, are manifestly unattributable to the ether. Of the sixth, No. 40, the details are very meagre, but that the death had any connection with the anæsthetic, is at least improbable. In the remaining seventeen cases where death was immediate, or nearly so, the connection between the result and the inhalation is either problematical or else manifestly absurd and unfounded, except in four instances, viz., cases 1, 25, 34 and 39, where it was due to asphyxia, brought about by wholly avoidable causes.

The administration of an anæsthetic *in articulo mortis*, as, for example, in an operation for strangulated hernia, may sometimes merge the sleep which it produces into the sleep of death, without the termination of the case being hastened by, or attributable to, the inhalation. Patients die from *croup* during an attempt to save life by tracheotomy, and may equally succumb to tetanus or delirium tremens during the inhalation of ether or chloroform. Cases 23, 27, 28 and 30, must be considered as instances belonging to such a category. Every one of the seven cases where no mention is made of the period after which death took place, admits strong doubt of the connection between the result and its cause, or else is insufficient in evidence to produce conviction.

The remaining cases of the table not yet accounted for, viz., Nos. 16, 19, 20, 24 and 29, are no better able to stand the test of examination. The character and circumstances of the operation in the first three certainly absolve the ether. In the 4th (No. 24), the nature of the injury as shown by the autopsy and the condition of the patient at the time of inhalation—it being such as in the unanimous opinion of those present would not permit the use of chloroform, together with the fact that he never was fairly etherized—point to some other cause than the anæsthetic to account for the fatal result. The history of, and the statements connected with, the remaining case (No. 29), equally exclude that from being relied on as an instance of death from ether.

The statements of any author, however distinguished in posi-

tion, not accompanied by proof in the form of *pièces justificatives*, must remain of no value in face of the direct evidence of your Committee, that their careful search of journals and monographs furnishes not a single conclusive case of death from the proper inhalation of pure sulphuric ether.

III. In contrast with the foregoing evidence, how striking is the admission of the staunchest partisans of chloroform, that no care on the part of the administrator, nor intrinsic chemical perfection, will insure the safety of the person breathing its vapor! Neither the skill of a Dr. Snow, nor the laboratory of Duncan, Flockhart & Co., appear to exempt those who inhale chloroform from the fatal calamities which sometimes ensue wherever it has been used.

In 1857, in a discussion before the Academy of Medicine, M. Ricord spoke of the use of chloroform as "an accident which complicated an operation;" and in 1859, the President of the Paris Société de Chirurgie, M. Hervez de Chegoin, seriously proposed the question, "Whether its use had not better be actually suspended until some method of using it with constant security shall be discovered, or, if it is to remain of so uncertain safety, even renounced altogether?"* In 1856, Mr. Erichsen, of London, in a letter to Dr. S. D. Townsend, of this city, said, that "when a patient was fully under the influence of chloroform he was on the verge of death."† The epithet "*fleau chloroformique*" is, therefore, no undeserved one, for in any man's hands chloroform may indeed become a scourge whose blows shall fall so suddenly and mysteriously, that before the surgeon's knife is taken up the patient's life may have passed away beyond resuscitation.

No such impressions have ever prevailed with regard to sulphuric ether. No one can die from it as he may die from chloroform. Dr. J. C. Dalton, in a letter to your Committee, speaking of the use of chloroform in the vivisection of animals, says, "I am convinced from my experience, that no caution will prevent its producing a fatal effect, and no care will enable the operator to see when the danger is threatened." On the other hand, with regard to ether, he states, "I never feel any anxiety as to the safety of

* Séance du 9 Mai, 1859.

† Records of the Boston Society for Med. Improvement, Vol. 3, p. 34.

an animal under etherization, provided I can myself watch the state of the pulse and respiration, or can rely upon the aid of a competent assistant for that purpose. So far as my observation goes, the dangerous symptoms in the case of ether can always be recognized, with ordinary care, in sufficient time to prevent a fatal result." Dr. John Snow declares that "he holds it almost impossible that a death from ether can occur in the hands of a medical man who is applying it with ordinary intelligence and attention."*

The more agreeable *odor*, the more *rapid result*, and the smaller *bulk*, are the only compensations offered as an offset to the suspended sword which thus hangs over the surgeon whenever he invokes the aid of chloroform.

The first of these advantages seems too unimportant to be serious; nor are all people of one opinion as to the more agreeable smell of chloroform. M. Roux talks of its "nauseating and sickishly sweet odor," as being more painful to inhale than that of ether;† and M. Sédillot says, that of patients submitted by him "sometimes to the use of ether and sometimes to that of chloroform, all have preferred ether."‡ Dr. Snow esteems the odor of, and the sensations produced by, ether as much more pleasurable than those of chloroform.§

Then, too, as to rapid action, a patient may be put by ether into a thorough anæsthetic condition, for the performance of a by no means short or trivial operation, in one minute and a third.|| Chloroform can hardly do more than that. Is the rapid production of anæsthesia, however, a desirable thing? It is an assertion, based upon statistics, that the early stage of chloroformization is the most dangerous.¶ The agitation and excitement of patients during the first moments of inhalation may explain this, as the rapidity and intensity of anæsthesia are in proportion to the activity of respiration and circulation. Such being the case, a gentler and slower anæsthetic than chloroform ought to carry the patient more safely over this dangerous period, by allowing the etherized blood gradually to penetrate the remotest parts of the system, and

* On Chloroform and other Anæsthetics, their Action and Administration, London, 1853, p. 362.

† L'Union Médicale, 4 Janv., 1843.

‡ De l'Insensibilité produite par le Chloroforme et par l'Ether, et des Operations sans douleur, Paris, 1843, p. 95.

§ Loc. cit., p. 357.

|| British and Foreign Med. Chir. Review, October, 1859, p. 352.

¶ Med. Times and Gazette, May 12, 1860.

thus avoid the prostration of a sudden and violent impression upon the nervous centres. The necessary duration of the anæsthetic condition, when gradually induced, must for the same reason be more satisfactorily ensured. A rapid anæsthesia, although complete, is apt to be of very short duration, and the patient may recover his sensibility as suddenly as he lost it. This does not occur so frequently when the anæsthetic has taken effect in a slower manner, and may be explained by supposing that a volume of the blood first charged in the lungs passes to the brain and narcotizes the patient, and that the blood which remains in the extremities, not yet touched by the vapor, will, if the process be arrested, in its turn flow through the brain and at once revive him. On the other hand, a more protracted inhalation, such as is usually the case with ether, ensures the gradual saturation of the whole circulation. Here, too, is an additional illustration of the important statement before made, that unless an operation is to be short, the surgeon should not be content with the appearance of the first symptoms of insensibility, but push the anæsthesia till the patient snores.

The advantages of chloroform in respect to portability are of little consequence in civil practice. But when an agent so much more compact than ether can be used in military hospitals and on the battle field, the necessity of reducing baggage to its minimum, demands, it has been alleged, that the less bulky anæsthetic should be preferred; and this argument is usually strengthened by a reference to the results of its use in the Crimea, viz., two deaths in 30,000 cases, one in the French and one in the English army. These statistics, apparently so conclusive, will not, as your Committee believe, stand the test of examination. How was it possible to obtain accurate information from every battery, rifle pit, or trench, where chloroform was given? What surgeon would not, under the circumstances in which it must constantly have been administered, be liable often to attribute to the effects of an injury fatal results really due to the anæsthetic—especially if it is true, as Dr. Snow states in a communication to Mr. Guthrie,* that to “take 10 minims of chloroform into the lungs when insensibility is almost complete, must be attended with danger.” A perusal of a letter of Dr. J. Hall, Inspector General of Hospitals in the

* Commentaries, London, 1855, p. 39.

Crimea, to the Director General at London,* or of a paper by Dr. Mouat, Deputy Inspector General in the English Army, read by him in the Crimea to the Crimean Medical Society,† will persuade the reader that more than one death from chloroform occurred during the war, amongst the British troops. Such certainly is that gentleman's impression, and it does not appear to have been either opposed or contradicted by the other members of the Crimean Society. Dr. Lente states that the assertion of Baudens, that only one fatal case happened amongst the French from chloroform, is denied by other surgeons, who themselves saw deaths occur from its use.‡ But whether this is true or not, that 30,000 soldiers should escape the dangers of chloroform, is no argument in its favor. It is well known that a vast number of missiles are thrown in battle without harming a single person, yet no one would pretend that this fact diminishes in the slightest degree the danger in the flight of a solitary bullet. The position of chloroform is precisely identical. If properly administered and economized, the amount of ether required for army use is not very great. The quantity necessary for a regiment, especially one with easy access to its supplies, cannot add much encumbrance to the stores of the hospital department. At all events, it might be used to a certain extent, and the soldier's life in a degree secured against the treachery of one foe not less dangerous than the bullets of the enemy.

The objection to ether on account of its inflammability does not apply with any more force to its use in armies than in private practice, and ordinary precautions will provide against accident from this cause.

The more trivial the operation for which chloroform is inhaled, the more care should be taken in its use, fully two thirds of the deaths from its effects having occurred during the performance of minor operations.§ The very opposite of this is true of ether. Only after long, protracted inhalation, during operations accompanied by great loss of blood, or involving great prostration of the general system, can any possible anxiety be felt.

The friends of chloroform admit that "over 150 deaths" have

* Med. and Surg. History of the British Army which served in Turkey and the Crimea during the War against Russia. "Blue Book," p. 269.

† Med. Times and Gazette, Aug. 30, 1856.

‡ American Journal of Medical Sciences, April, 1861.

§ British Med. Journal, Feb. 21, 1857. Med. Times and Gazette, May 12, 1860.

already occurred from its use.* This, it is urged, is only about $11\frac{1}{2}$ per year since its first application in 1848. Had as many fatal cases happened in that period from opium, aconite, arsenic, strychnia, or other poisonous drugs, administered by regular physicians, would the use of such agents still be authorized? And how much stronger would the case be, did they produce death in the unexpected and sudden manner in which chloroform strikes its victims!

The objections to chloroform apply with equal force to chloric ether, which is chloroform diluted with alcohol, to amylene, and to the mixture of sulphuric ether and chloroform, in whatever proportion. The dangers of this last are well shown in a case reported in the Appendix, where a boy 5 years of age died within three or four minutes after breathing a mixture of four parts of ether and one of chloroform. The addition of chloroform to ether being unnecessary, only renders dangerous an anæsthetic which is otherwise safe, and is liable to lead to a carelessness in its administration which would not occur with chloroform, and might prove as dangerous as when that anæsthetic is alone used in an unadulterated state.† Of the new agent, "kerosolene," recently discovered in this city, the remarkable physical properties of which are so attractive, sufficient experience has not yet been had to authorize an opinion upon its future value.

Of the action of anæsthetics on the system, we have but an imperfect and inconclusive knowledge. The following statements are cited from the work of Lallemand, Perrin and Duroy, already referred to. This recent and elaborate treatise depends for its facts upon numerous experiments on animals, and upon such carefully-conducted researches as entitle it to confidence.

* Dublin Med. Press, June 5, 1861.

† It has been said that a mixture of ether and chloroform was employed with great success by the French in the Crimean war. There is no published documentary evidence to prove that such a combination was adopted. No mention is made of it by the Inspector-General at the head of the French Medical Service in the Crimea. On the contrary, a correspondence between that officer and the General-in-chief leaves no possible doubt as to the exclusive use of chloroform; his general remarks, also, render it certain that no other anæsthetic was substituted at any time during the war. (*Rélation Médico-Chirurgicale de la Campagne d'Orient*. Paris, 1857. Pp. 123, 160 and 456.) In none of the Journals of the period, nor in the English Government Report of the Medical History of the War, is there any statement leading to the inference that a mixture of ether and chloroform was used by either army during that campaign, or anything which can authorize the supposition that the word "chloroform" is used as synonymous with "anæsthetic," and therefore includes in its meaning the combination said to have been employed. A point so important could not fail to be set forth in distinct terms in such careful reports as were made after the Crimean war.

1st. Anæsthetics are neither transformed nor destroyed in the system, but are rapidly eliminated from it, chiefly by the lungs, and to a limited extent by the cutaneous surface. Chloroform and amylene being insoluble in water, no traces of them are ever found in the urine. Sulphuric ether being more soluble, a small quantity of this may be detected by re-agents in the renal secretion.

2d. The blood and the organs of animals dead from *etherism* (the name given to this special intoxication by the above-named authors), contain the anæsthetic agent employed, the presence of which is easily determined by special chemical research; and the following figures show in what proportion the principal viscera contain the anæsthetic, in reference, for each of the agents employed, to the quantity found in the blood.

SOURCE OF ANALYSIS.	CHLOROFORM.	SULPH. ETHER.	AMYLENE.
Blood,	1.00	1.00	1.00
Cerebral substance,	3.92	3.25	2.06
Liver,	2.68	2.25	1.00
Muscular tissue,	0.16	0.25	Traces.

From this it appears that anæsthetics accumulate in the cerebro-spinal system.

3d. It is not easy to explain the deaths from chloroform and amylene, or from ether (as sometimes seen in the lower animals), but it would seem probable, both from the phenomena which they present and the experiments which have been made, that they are the consequence of an abolition of the functions of the nervous system, and not of asphyxia.

The general conclusions which have been arrived at by your Committee may be summed up as follows:—

1st. The ultimate effects of all anæsthetics show that they are depressing agents. This is indicated both by their symptoms and by the results of experiments. No anæsthetic should therefore be used carelessly, nor can it be administered without risk by an incompetent person.

2d. It is now widely conceded, both in this country and in Europe, that sulphuric ether is safer than any other anæsthetic, and this conviction is gradually gaining ground.

3d. Proper precautions being taken, sulphuric ether will produce entire insensibility in all cases, and no anæsthetic requires so few precautions in its use.

4th. There is no recorded case of death, known to the Committee, attributed to sulphuric ether, which cannot be explained on some other ground equally plausible, or in which, if it were possible to repeat the experiment, insensibility could not have been produced and death avoided. This cannot be said of chloroform.

5th. In view of all these facts, the use of ether in armies, to the extent which its bulk will permit, ought to be obligatory, at least in a moral point of view.

6th. The advantages of chloroform are exclusively those of convenience. Its dangers are not averted by its admixture with sulphuric ether in any proportions. The combination of these two agents cannot be too strongly denounced as a treacherous and dangerous compound. Chloric ether, being a solution of chloroform in alcohol, merits the same condemnation.

R. M. HODGES,
GEO. HAYWARD,
S. D. TOWNSEND,
C. T. JACKSON,
J. BAXTER UPHAM.

The foregoing report was accepted, and its conclusions adopted by the Society.

FRANCIS MINOT, *Secretary*.

Dr. C. T. Jackson, one of the Committee, objects and excepts to the clause in this report in which "all mixtures of ether and chloroform" are denounced; viz., to the words, "the dangers of chloroform are not averted by admixture with sulphuric ether," and to the terms, "treacherous and dangerous compound" of ether and chloroform. He believes that a mixture of four measures of ether and one measure of chloroform may be employed without danger, or with very little danger, and that the risks from chloroform are diminished more than four fifths by this combination. He believes it to be necessary to have an anæsthetic agent of less bulk than ether, and not so dangerous as chloroform, for army uses, and is satisfied that this mixture, which he has employed and prescribed, completely answers the purpose required.

Table of Alleged Deaths from the Inhalation of Ether.

No.	Operator or Reporter.	Datc.	Locality.	Sex.	Age.	Operation, or purpose for which it was administered.	Period after which Death occurred.	Probable cause of death.
1	Figuier.	1847	Auxerre, France.	M.	55	Cancer of Breast.	During op.	Asphyxia.
2	Robbs.	1847	England.	F.	21	Tumor of thigh.	40 hours.	Shock and exhaustion.
3	Eastment.	1847	"	M.	11	Amputation of thigh.	3 hours.	Shock of accident & op.
4	Nunn.	1847	"	M.	62	Lithotomy.	50 hours.	Shock and exhaustion.
5	Taylor.	1847	"	—	—	—	—	Case similar to preceding
6	Robinson.	1847	"	M.	70	Amputation.	4 days.	Shock, exhaustion, age.
7	Kopecky.	1847	Vienna, Austria.	M.	—	Amputation of thigh.	6 days.	Pneumonia. [health.]
8	Roel.	1847	Madrid, Spain.	F.	50	Cancer of Breast.	8 hours.	Shock and state of gen'l
9	Kopecky.	1847	Vienna, Austria.	F.	—	Amputation of arm.	5 days.	Pleuritis.
10	Jobert.	1847	Paris, France.	F.	33	Cancer of breast.	16 days.	Erysipelas & bronchitis.
11	Jobert.	1847	"	F.	47	Amputation of thigh.	15 days.	—
12	Mendoza.	1847	Barcelona, Spain.	F.	60	Amputation of leg.	15 hours.	Shock of accident & op.
13	Schuh.	1847	Vienna, Austria.	F.	26	Amputation of thigh.	4 days.	Pyæmia.
14	Kopecky.	1847	"	M.	—	Amputation of thigh.	13 days.	—
15	R. D. Mussey.	1847	N. Hamps., U. S.	M.	—	Lithotomy.	5 to 6 hours.	Shock.
16	Johnson.	1853	Virginia, U. S.	F.	—	Excsect. of entire lower jaw.	During op.	Shock, hæmorrhage, &c.
17	Forbes.	1847	England.	Boy.	—	Lithotomy.	Many days.	Intense local inflam.
18	Humphry.	1848	"	M.	—	Amputation of arm.	3 days.	—
19	Barriere.	1852	Lyons, France.	F.	55	Excision sup. maxilla.	During op.	—
20	De Oettingen.	1847	Dorpat, Russia.	M.	70	Amputation of thigh.	"	Shock.
21	Lewis.	1847	Boston, U. S.	M.	—	Amp. at shoulder-joint.	12 hours.	Shock of accident & op.
22	Richet.	1847	Paris, France.	M.	43	"	11 days.	Capillary bronchitis.
23	—	1860	New York, U. S.	—	—	Op. strang. hernia.	"	[thaps fat. deg. of heart.
24	W. H. Mussey.	1860	Ohio, U. S.	M.	50	Surgical examination.	15 to 20 min.	Comm. frac. os inn., per-
25	—	1860	New York, U. S.	—	—	"	During inhal.	Asphyxia.
26	Rigaud.	1847	Paris, France.	M.	63	"	4 days.	Bronchitis.
27	Bassett.	1847	Alabama, U. S.	—	—	Actual cauterization.	During inhal.	Tetanus.
28	Roux.	1847	Paris, France.	—	—	Tetanus.	—	—
29	Clark.	1859	New York, U. S.	F.	27	Intense headache.	During inhal.	Disease of the brain.
30	—	1855	Boston, U. S.	M.	32	Delirium tremens.	"	Delirium tremens.
31	Piedagnel.	1847	Paris, France.	M.	—	—	15 days.	Arachnitis.
32	Eve.	1849	Kentucky, U. S.	M.	—	Exhilarating effects.	4 days.	Symptoms of meningitis.
33	Miller.	—	"	F.	15	"	12 days.	—
34	Payne.	1851	London, Eng.	M.	—	As an anodyne.	—	Asphyxia.
35	Velpeau.	1847	Paris, France.	F.	60	Tumor of breast.	3 days.	Acute pulmonary disease
36	Roux.	1847	"	—	—	Opening of an abscess.	3 days.	Exhaustion.
37	Roux.	1848	"	M.	82	Lithotomy.	—	—
38	Bergson.	1847	Berlin, Prussia.	M.	—	Lithority.	—	—
39	Velpeau.	1847	Paris, France.	—	—	Excision of tonsils.	—	Asphyxia.
40	Scoutetten.	—	Metz, "	M.	50	—	4 hours.	—
41	Giraldes.	1860	—	—	—	—	—	—

ETHER AND CHLOROFORM COMBINED.

1	Crockett.	1857	Virginia, U. S.	M.	5	Fatty tumor.	At end of op.
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ETHER AND SUBSEQUENTLY CHLOROFORM.

1	March.	1854	Albany, U. S.	F.	18	Tumor of neck.	2 hours.
2	Valette.	1855	Lyons, France.	—	—	—	During inhal.

CHLORIC ETHER.

1	—	1853	Lynn, U. S.	F.	—	Extraction of tooth.	During inhal.
2	Haynes.	1852	N. Hamps., U. S.	F.	—	Tumor of thigh.	15 to 20 min.
3	Ingalls.	1852	Chelsea, U. S.	M.	20	Evislusion of toe-nail.	During inhal.

CHLORIC ETHER AND CHLOROFORM.

1	Foltz.	1852	East Boston, U. S.	—	—
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RESUME OF 41 CASES OF ALLEGED DEATH FROM SULPHURIC ETHER.

In 6 cases death occurred in from 11 to 16 days.	In 3 cases death occurred in from 3 to 6 hours.
In 9 " " " " 3 to 6 days.	In 1 " " " " from 15 to 20 minutes.
In 1 " " " " after "many days."	In 4 " " " " during the operation.
In 2 " " " " from 40 to 50 hours.	In 4 " " " " inhalation.
In 3 " " " " from 8 to 15 hours.	In 8 " " the time which elapsed is not stated.

There are also a certain number of cases so indefinite in their details, or where the cause of death is so manifestly unconnected with the inhalation of sulphuric ether, as not to admit of being tabulated. The ascertained facts of these are stated in the Appendix.

A P P E N D I X .

The following enumeration of cases comprises those contained in the tables of Scoutetten, Bouisson, Snow, Kidd, and of all other authors known to the Committee. Whenever it has not been possible to verify an assertion, as that, for instance, of Trousseau, the statement of cases which is made is given as it occurs.

1. Hotel Dieu of Auxerre, France, 1847. A man, 55 years old, after having breathed sulphuric ether, was operated on for cancer of the breast, and died during the operation with evident symptoms of asphyxia. The ether was inhaled from a Charrière's apparatus. "The want of care in administering the ether, which was given in a manner likely to produce asphyxia, and the insufficient means used for the restoration of the patient, sufficiently explain the cause of death." (*Exposition et Histoire des Principâles découvertes Scientifiques modernes*, par Louis Figuier, Paris, 1851, t. ii., p. 282. *Gaz. Médicale*, 4 Mars, 1848, p. 170.)

2. Mr. Robbs, Grantham, Eng., 1847. Ann Parkinson, aged 21, inhaled sulphuric ether several times, experimentally, preparatory to an operation for removing a large, malignant tumor in the soft parts of the thigh. At the first trial, after breathing 15 or 20 minutes, she became hysterical and comatose for two hours; at the second trial she became comatose in 4 minutes, recovering rapidly. The next day she inhaled it for 10 minutes prior to the operation, which lasted half an hour, and during which she manifested great pain, declaring afterwards that she felt every cut that was made; she was in a state of great exhaustion when the operation was completed, being obliged to have brandy before it was quite over, and more when she was put to bed. She was conscious from the time of the operation to her decease, 40 hours afterwards, but spoke in a low, faint voice. All the natural functions were sluggish.

At the autopsy it was found that there was some congestion of the brain and lungs, and the blood was fluid. There were no other unusual appearances. (*London Medical Gazette*, Vol. 39, p. 585.)

3. Mr. Eastment, Wincanton, Eng., 1847. Albin Burfitt, 11 years old, received a compound fracture of the left femur, with great laceration of the soft parts, and a simple fracture of the right thigh, from entanglement in machinery. Amputation was necessary. Little blood had been lost, and at the end of 8 hours the reaction and strength were sufficient for the operation. Sulphuric ether was given, and after 3 or 4 minutes apparently had its effect, but the first incision caused terrible pain. The inhalation was therefore repeated for 3 minutes, insensibility was produced, and the operation was completed without much loss of blood. The patient, however, remained exhausted, delirious and intoxicated, and died in three hours, his delirium changing to syncope. No autopsy was made. (*London Med. Gazette*, Vol. 39, p. 631.)

4. Mr. Nunn, Colchester, Eng., 1847. Thomas Herbert, aged 52, inhaled sulphuric ether for 8 minutes, at intervals, but without marked effect. The operation of lithotomy was then performed, requiring ten minutes, the stone being grasped with difficulty. The patient recovered from the effects of the ether, but remained exhausted, without reaction, for 24 hours. He then had chills, one of which lasted 20 minutes, and fell into a state of increasing weakness and collapse, which, at the end of 50 hours from the operation, terminated in death. At the autopsy, the meninges of the brain were found congested; and none of the substance of the brain was found firm. The heart was flabby and empty; blood, fluid. The left kidney was congested; bladder as after lithotomy. Other organs not remarkable. (*London Medical Gazette*, Vol. 39, p. 414.)

5. Mr. Taylor says that a case, similar to Mr. Nunn's, where sulphuric ether was inhaled, "was privately communicated to him by an eminent London surgeon, and in which he stated that there could be no doubt of the vapor having been the direct cause of death. The patient sank after the operation, under symptoms which in similar circumstances he had never before witnessed." (*On Poisons*, Lond. Ed., p. 783.)

6. Mr. Robinson, Eng., 1847. A gentleman, aged 70, breathed sulphuric ether for an amputation, but was not completely affected by it, as he gave signs of suffering, and said afterwards that he felt pain during the operation. The immediate effects, such as they were, passed off speedily, and he was able to take some wine before being removed from the table. He seemed to do pretty well for a time, though never rallying satisfactorily. He however lived nearly 4 days,

presenting various anomalous, nervous symptoms; amongst others, slightly recurring delirium. The stump did not take on a healthy reparative process. (*British and Foreign Med.-Chir. Review*, Vol. 23, p. 558.)

7. Kopezky, Vienna, 1847. Amputation of the thigh, under sulphuric ether, for white-swelling of the knee, in a man, lean and cachectic, from long duration of the disease. On the third day from the operation the wound became gangrenous; on the fourth day he had dyspnœa, and on the sixth he died without any considerable rigor or heat of the skin having been noticed.

At the autopsy, the lungs were found inflamed at various points, and the femoral artery, for an inch above the wound, was also inflamed. The heart and great vessels were filled with soft, pale coagula. (*Warnung vor der Schädlichen Wirkungen der Äther-Einathmung*, B. Kopezky, Wien, 1847.)

8. Roel, Madrid, 1847. Dolores Lopez, an intemperate female, aged 50, in a condition of hectic and with shortness of breath, inhaled sulphuric ether for the removal of a scirrhus tumor of the breast, weighing $3\frac{1}{2}$ pounds. The anæsthesia was incomplete, though the pain of the operation was slight. The loss of blood was not great. From 10 o'clock, when she was etherized, till $12\frac{1}{2}$ o'clock, she remained stupid. Soon afterwards the pulse became thready, and there was sub-delirium. In about 8 hours from the operation she died.

At the autopsy, the firm, arborized brain was found infiltrated with serum both externally and internally. Sinuses full. The lungs show signs of old trouble, and are partially congested. Blood, fluid. (*Ueber Äther Rausch*. E. Nathan, Hamburg, 1847.)

This case is cited by the operator and by M. Chambert, as a characteristic one, of death from ether.

9. Kopezky, Vienna, 1847. The arm of a female was amputated under sulphuric ether, on account of a crushed hand and elbow-joint. A simultaneous injury of the ankle-joint seemed unimportant. For two days the patient did well. On the third, the wound became foul, the injury of the ankle inflamed and looked sloughy. The patient became feverish, drowsy, jaundiced, delirious, had dyspnœa, and without any rigors died on the 5th day after the operation.

At the autopsy a slight exudation was found on the inner surface of the dura mater. There was inflammation of the pulmonary and costal pleura. The blood was fluid, and the heart was filled with soft, pale coagula. (*Warnung vor der Schädlichen Wirkungen der Äther-Einathmung*. B. Kopezky, Wien, 1847.)

10. Jobert, Paris, 1847. On the 15th of January, a cancerous tumor was removed from the breast of a female, aged 33. To do this,

sulphuric ether was exhibited, but at the end of 13 minutes insensibility had not been produced. The ether was therefore abandoned, and the operation commenced. The patient cried out, and complained of her intense suffering. During the remainder of the day, and the next, she had a cough, with intense headache and restlessness; mucous râles were detected on auscultation. On the 22d, erysipelas made its appearance around the wound; on the 23d, and following days, bronchial râles filled the whole chest; the erysipelas spread, and covered all the posterior part of the trunk. The prostration was complete, and the cough obstinate. From the 27th to the 30th, the erysipelas extended to all parts of the body; chills and vomiting occurred, and on the 31st she died.

At the autopsy, a diffused redness of the mucous membrane of the bronchi, and engorgement of the lungs, were found. (*Des Effets physiologiques et thérapeutiques des Ethers*. H. Chambert, Paris, 1848.)

11. Jobert, Paris, 1847. A female, aged 47, underwent amputation of the thigh for white-swelling. Perfect anæsthesia was induced by breathing sulphuric ether for four minutes. After the operation, the pulse and temperature of the body failed, and there was insensibility for several hours. It was subsequently observed that there was but little traumatic fever. Seven days after the operation, there appeared an ocular and facial neuralgia, and a contraction of the masseter, sterno-mastoid, abdominal and thoracic muscles. These were looked upon as symptoms of tetanus, and the patient finally died from a variety of lesions of the circulatory, nervous and respiratory systems, 15 days after the operation.

The autopsy showed the vessels of the pia mater of the brain and spinal cord to be greatly injected. The tissue of the brain, especially at the optic thalami and corpora striata, was also much injected. The ventricles of the brain were well filled with serum. The pharynx and œsophagus were quite reddened, and covered with pus, as also were the trachea and bronchi. (*Des Effets physiologiques et thérapeutiques des Ethers*. H. Chambert, Paris, 1848.)

M. Jobert considered this a case of poisoning of the blood, due to the anæsthetic. The appearances could not be laid to pyæmia, but were incontestably due to the effects of ether. In this opinion, M. Chambert, the reporter, coincides.

12. Mendoza, Barcelona, Spain, 1847. A female, aged 60, underwent amputation of the leg, three days after suffering a comminuted fracture of the foot, which had been crushed by a wheel. Sulphuric ether was given, but it caused great uneasiness and cough; insensibility was, however, obtained at the end of a quarter of an hour, but it lasted only a few minutes. After attempts at re-etherization had

been continued for half an hour, an hour was given her to recover her strength. She then breathed it again and was put to sleep in 6 minutes. She called out a little when the skin was cut, but afterwards remained silent. Although the pulse was full, the patient's exhaustion was manifest, and after the ligatures were applied she had a violent nervous attack, which was overcome by stimulants and the admission of fresh air. She then lay quiet, but exhausted, answering questions with a weak voice, though remembering nothing which had passed. This forgetfulness persisted, she became stupid, with a weak pulse, and heavy and stertorous breathing; her strength failed more and more, and she died 15 hours after the amputation. (*Révue Médicale*, April, 1847.)

13. Schuh, Vienna, 1847. A female, aged 26, had her thigh amputated for white-swelling of the knee-joint. Her condition was one of hectic, and she had scrofulous sores and enlargements in various parts of the body. She inhaled sulphuric ether for the operation, and the anæsthesia lasted 10 minutes. Although the patient soon spoke rationally, her memory did not return for three hours. In the evening she felt weak, her head was hot, and she was in an excited condition. The following day she slept nearly all the time, only waking to drink; her pulse was quick and feeble. During the ensuing night she was delirious, and the pulse became imperceptible, and she had chills and pain in the abdomen. Afterwards the extremities became cold, the discharge from the wound offensive, the stump painful along the course of the vessels, and the wound gangrenous. She died on the 4th day.

At the autopsy the pia mater was found slightly injected; the lungs were healthy, as was the heart, which contained some soft coagula. In the liver there were several small abscesses, and a very large number in the spleen. The vessels of the stump were inflamed as far as the pelvis. (*Warnung vor der Schädlichen Wirkungen der Æther-Einathmung*. B. Kopezky, Wien, 1847.)

Professor Schuh said that this case left no doubt that the uncommon strength of the narcosis helped, if it did not cause the gangrene and formation of pus.

14. Kopezky, Vienna, 1847. A large hydrocele, with partially bloody contents and uncommon thickening of the tunica vaginalis, occurring in a pale, lean, very timid young man, was treated by incision, after inhaling sulphuric ether. All went well for several days. The thick tunica vaginalis softened and granulated throughout. The patient was on full diet, and no doubts were entertained as to his recovery. Twelve days after the operation the discharge of pus ceased suddenly, the cord became tender, and the wound was covered

with a light-grey, lymph-like coat; the surrounding parts became oedematous, and the wound looked as if attacked by hospital gangrene. The next day he became delirious, had vomiting, although the tongue was clean, and died.

At the autopsy, the meninges of the brain were found infiltrated with serum, and the brain itself was slightly engorged with blood. Three small abscesses were found in the cellular tissue of the spermatic cord. Greenish-yellow coagula were entangled with the valves of the heart. (*Warnung vor der Schädlichen Wirkungen der Äther-Einathmung.* B. Kopecky, Wien, 1847.)

The reporter repudiates the idea that hospital gangrene or pyæmia were the cause of death in this case.

15. Dr. R. D. Mussey, New Hampshire, U. S. A young man was operated on for stone in the bladder, by the bi-lateral method. He had been very much exhausted by suffering, and obtained snatches of sleep only by large and frequently repeated doses of opium. Surgical interference seemed to promise almost nothing, yet it was preferred. Sulphuric ether was inhaled. Immediately after the operation, which was a slow and tedious one, the patient was put to bed; he sunk into a disturbed sleep and died five or six hours afterwards. The stone was a mulberry one, and as large or larger than any Dr. Mussey had ever seen. Dr. Mussey says, "I do not suppose that the ether had much, if anything, to do in shortening life; I had the opinion, and still have, that, prostrated as he was, he died from the shock of the operation. (*Committee's Correspondence.*)

16. Dr. C. P. Johnson, Richmond, Va., 1853. A negress of middle age had, three months previously, undergone resection of the parts adjoining the symphysis of the lower jaw, for an osteoid cancer of the parts. The disease re-appeared and rapidly invaded the neighboring structures, involving a considerable portion of the remnants of the body and ramus of each side. The patient's appearance was cachectic. A complete disarticulation was decided upon, and sulphuric ether was administered. The operation was tedious. After the separation of the diseased mass, the branches of the internal maxillaries gave so much trouble, that one, if not both, the carotids were tied. The regularity of the patient's stertorous breathing was not interrupted till just before the close of the operation. As soon as this was noticed, some brandy and water was passed into the fauces, but was regurgitated with the production of one or two spasmodic actions about the glottis, which were the last vital manifestations that occurred. Artificial respiration, frictions, &c., induced no response.

The tissues were found exsanguine at the autopsy. (*Committee's Correspondence.*)

17. Dr. Forbes, London, 1847. A boy underwent lithotomy. All the primary effects of the sulphuric ether which he inhaled passed off as usual. He lived "many days," and although said to have died from the effects of the ether, his death, in the opinion of the reviewer who cites the case, was due to the effects of local inflammation. (*British and For. Med. Chir. Review*, Vol. 23, p. 558.)

18. Dr. G. M. Humphry, Cambridge, Eng., 1848. "A lad died with peculiar symptoms of oppression of the sensorium, preceded by delirium, three days after amputation of the arm on account of accident. Sulphuric ether was administered; its effect was complete and soon passed off, so that he slept well, and the delirium did not appear till the next morning. We cannot with certainty attribute this case to the ether." (*Provincial Med. and Surg. Jour.*, Aug. 9th, 1848.)

19. M. Barriere, Lyons, France, 1852. A female, aged 55, in a weak and bad state of general health, underwent excision of the superior maxillary bone. Sulphuric ether was given from a sponge placed in a bladder. Death occurred during the operation. It was thought possible that it might have been due to the hæmorrhage. (*Gazette des Hopitaux*, June 18, 1853.)

20. Dr. G. de Oettingen, Dorpat, Russia, 1847. Constantly increasing anæmia, on account of a gangrenous ulceration of the leg, rendered amputation necessary in the case of an old man, 70 years of age. Sulphuric ether was administered from a common bottle having an opening large enough to include the nose and mouth of the patient. The operation was completed, but the arteries were not tied when the indications of approaching death were noticed, and which shortly occurred with symptoms of syncope. There was no hæmorrhage.

The autopsy gave no explanation of the death. (*Committee's Correspondence*.)

21. Dr. Winslow Lewis, Boston, 1847. A young man of very intemperate habits, during a state of intoxication, caught his arm in the large cog-wheels of a dough-kneading machine, by which it was so torn and lacerated as to require disarticulation at the shoulder-joint. The patient was in a very weak and feeble condition when sulphuric ether was administered and the limb removed. Little blood was lost, either before or during the amputation. He recovered from the anæsthesia, but died the next day, about twelve hours after the operation.

As one of the earlier capital operations performed with anæsthetics, it was thought that ether might have had something to do with the result of this case, but the patient's condition was such, that his death was to be anticipated from the combined effects of his habits, the accident and the operation, whether ether had been used or not. (*Committee's Correspondence*.)

22. M. Richet, Paris, 1847. A man, aged 43, underwent amputation at the shoulder-joint for an enormous tumor developed about the upper part of the humerus. During the dressing, the patient fainted three times. Subsequently his strength gradually failed, a cough set in, and he died on the eleventh day after the operation. M. Richet attributed the death to the ether, but his *interne* exhibited the lungs to the Anatomical Society as specimens of capillary bronchitis. (*De l'Ether Sulphurique*, par F. J. Lach, Paris, 1847.)

23. Dr. ———, New York, 1860. "A patient with hernia had been laboring under symptoms of strangulation for some time, and was in a desperate condition. A cutting operation for his relief was resolved upon. He was fully anæsthetized with sulphuric ether, and suddenly, during the progress of the operation, showed symptoms of prostration and soon died." (*Committee's Correspondence*.)

24. Dr. W. H. Mussey, Cincinnati, O. A man, 50 years old, by the upsetting of his wagon had been dragged 30 feet and then rolled down an embankment 8 feet high, when his wife, weighing 205 lbs., fell upon him. The patient himself weighed 230 lbs., was occasionally intemperate, having had a debauch ten days previous to his accident, and been quite sick in recovering from it. After his injury he had to be transported a mile in order to reach his house, and during the thirty hours ensuing he suffered intense pain, and took four grains of morphine in divided doses. In order to examine an injury which had befallen his hip, four ounces of sulphuric ether (it being the unanimous opinion of those present that his condition would not permit the use of chloroform) was administered, with great care and precaution. "At the time of seizing the limb for examination,"—we quote from Dr. Mussey's own account,—"a peculiar shortness of breath of an asthmatic character was noticed, and it was stated that he was subject to attacks of asthma. On observing this phenomenon, the use of ether was suspended and not resumed; the manipulation was, however, proceeded with, the patient screaming out and writhing with pain, and apparently perfectly conscious. Seeing that his lips were purplish and his breathing very short, I proceeded to administer for his relief. He called for water; a little was given him, and a little vinegar was put in it; finally, some whiskey was procured and administered in warm water. But little, however, was taken. The patient complained that he was suffocating, and the tongue was drawn out, though there was no lack of control of it, as he put it out to take stimulants. He was rolled upon his side; water was thrown in his face; first cold, then hot water applied to his forehead; the Marshall Hall method of artificial respiration, and the additional one of inflating the lungs from my own lungs, with forced expulsion of air, and flagellation of buttocks,

were continued 15 to 20 minutes, when the patient was abandoned as dead."

At the autopsy, a space six inches in diameter in the right iliac and lumbar region was found blackened and purple with extravasated blood, and this extended anteriorly and superiorly upon the wall of the abdomen. It also extended through the entire pelvic cavity, and beneath the pelvic fascia there was a large deposit of blood. The source from which this emanated was a most extensive fracture (which in fact might be called comminuted) of the os innominatum, radiating in all directions from the acetabulum to the circumference of the bone. There was a large amount of adipose tissue upon and around the pericardium, and fatty deposits on the auricles of the heart, which had no structural disease other than an absence of the usual redness and firmness of the tissue. Nothing of importance presented itself in the rest of the examination.

"A lengthy discussion arose in the Academy of Medicine of Cincinnati,"—where this case was presented,—“occupying two evenings of its session, in which two members contended that the case was clearly one of death from ether. Of the remaining disputants, two thought ether possibly auxiliary, while the majority considered ether not at all responsible.” (*Cincinnati Lancet and Observer*, Jan. 1861.)

25. Dr. ———, New York, 1860. “A very large, old, scrotal hernia had from some cause become irreducible. Inhalation of sulphuric ether was resorted to, and, while the patient was under its full influence, the hips being raised and the head allowed to be forcibly flexed upon the chest, the taxis was resorted to. The large mass of intestines very suddenly receded into the abdomen, and just at the moment the patient was noticed to be in a dying condition, from which he could not be recovered.” (*Committee's Correspondence*.)

It is intimated that too little attention was probably given to the state of the respiration and the pulse. The absence of an autopsy in this instance is greatly to be regretted.

26. M. Rigaud, Paris, France. A man, 63 years old, suffering for a long while from chronic bronchitis and asthma, underwent taxis for a strangulated hernia of two days standing. Sulphuric ether being administered, reduction took place, after fifteen minutes manipulation. The patient was suffering, in addition, from trismus. During the night, dyspnoea, cough and thirst, were complained of. These chest-symptoms persisting, death took place on the fourth day, during an asthmatic paroxysm.

At the autopsy, emphysema and the ordinary appearances of chronic bronchitis were noted. (*De l'Ether Sulphurique*, par F. J. Lach, Paris, 1847.)

27. Dr. J. Y. Bassett, Alabama, 1847. It was proposed to apply the actual cautery in a case of tetanus. Sulphuric ether was administered by a dentist. "At this time the patient's pulse was good, and there were no signs of an immediate extinction of life. In one minute the patient was under its influence; in a quarter more he was dead—beyond all my efforts to produce artificial respiration or to restore life. All present thought he died from inhaling ether." (*Amer. Jour. Med. Sciences*, Vol. 18, p. 293.)

28. M. Roux, Paris, 1847. A patient, in an advanced stage of tetanus, following upon the removal of one of his testicles by himself, was treated by the inhalation of sulphuric ether. In two minutes, complete insensibility was produced, which lasted nine minutes and then passed off, so that questions were readily replied to. Four minutes afterwards he became pale, the pulse failed, and death took place "at the end of the visit." (*De l'Ether Sulphurique*, par F. J. Lach, Paris, 1847.)

29. Dr. A. Clark, New York, N. Y., 1859. A female, aged 27, entered the Bellevue Hospital on account of frequent attacks of intense headache, accompanied by double vision, vertigo, nausea and vomiting. During the last four or five weeks of her life, there was unsteadiness of gait and irregularity in the movements of the hands, and these symptoms were increasing. The inhalation of sulphuric ether was the only thing which relieved the headache, and had been used three times with complete success. On the 25th of April, she inhaled it again on account of the severity of the pain. In a few moments, voluntary respiration ceased, the countenance became livid, and the pulse rapid, though of tolerable strength. Artificial respiration was kept up for seven hours, together with other means to preserve life, but at the end of that time they were abandoned as fruitless.

At the autopsy, a tumor in the right lobe of the cerebellum was found, $2\frac{1}{2}$ inches wide and $\frac{3}{4}$ of an inch thick. It resembled colloid cancer, and pressed upon the medulla oblongata. The blood was fluid. (*New York Monthly Review and Buffalo Journal*, Oct. 20, 1859.)

Dr. Clark quotes two cases of death from tumor of the cerebellum, reported in a Liverpool Journal, where the termination was as abrupt and unexpected as in this.

30. Mass. General Hospital, 1855. A man, aged 32, much addicted to drinking, sustained a compound fracture of the left leg, the tibia protruding an inch. Five days after the accident, delirium tremens appeared. On the second day of the attack, the patient's wife was told that he could not live. He was exhausted, bathed in perspiration, and had a feeble and rapid pulse. His delirium was such that the house pupil undertook to etherize him. He made the usual strug-

gles, and had some opisthotonic spasms. The ether had been continued some minutes, when the breathing was noticed to be abdominal, although the pulse was quick and sufficiently strong. Within a quarter or half a minute, the pulse suddenly ceased. The lips were not blue, and the head and hands were warm. The patient was dead, and no efforts to restore life were of avail.

At the autopsy, the sub-arachnoid fluid was found in larger amount than usual. Nothing remarkable about the brain. The heart was soft and flaccid, and contained some yellow, gelatinous coagula in the right side, and a small quantity of fluid blood in the left. There was no valvular disease. The liver was fatty. The kidneys and other organs were healthy. (*M. G. H. Records*, Vol. 65, p. 20.)

31. M. Piedagnel, Paris, 1847. A patient was admitted to the Hospital of St. Antoine, on account of a slight cough. One of the residents induced him to inhale sulphuric ether for the extraction of a tooth. This he did on three consecutive days, without producing insensibility. The first day's inhalation lasted twenty minutes, and the second day's thirty minutes. Finally, he determined to have the tooth taken out without ether. Seven or eight days afterwards he was attacked with fever and loquacious delirium, and died in fifteen days from the first etherization. The autopsy showed intense arachnitis. M. P. was convinced that the ether was the cause of this inflammation. (*Journal de la Soc. Méd. d'Emulation*, June 2d, 1847.)

32. Dr. P. F. Eve, Kentucky, 1849. A medical student inhaled two ounces of sulphuric ether, on account of its exhilarating effects. The time spent in inhaling this amount was reported to have been considerable. He became furiously excited, and it required several persons to control him. He was finally forced upon a bed, where he fell asleep. On being awakened he again became excited, so much so that cold water was dashed over him. He then went to his bed again, and nothing special was noticed till the next morning, when he awoke perfectly rational, but complaining of great pain in his forehead. He was prescribed for, and subsequently a consultation was held. Symptoms of meningitis were developed, and persisted, in spite of all treatment, and he died four days after the inhalation. (*Am. Jour. Med. Sciences*, Vol. 18, p. 293.)

No autopsy was made, nor is anything told of the previous history and condition of the patient.

33. Dr. Miller, Kentucky. A young lady, 15 years old, made five trials at inhaling sulphuric ether for amusement. It left an uncomfortable feeling, but she was out during the two following days, and on the third went to church. That evening she began to feel sick, and subsequently became delirious, "evinced alarm at imaginary dangers,

and speaking of the ether which she had inhaled as being the cause of her illness; she declared, in her lucid intervals, that she had suffered ever since she breathed it, and cautioned those around her against its use."*****" When any subject was introduced, she spoke rationally upon it for a moment, and then turned to some other, frequently to the experiments with the ether. Her nights became sleepless, and were spent in screaming and loud talking upon all subjects, until she finally sank into a comatose condition, and died on the twelfth day. (*Phila. Med. Examiner.*)

The three cases just given (Nos. 31, 32, and 33), and the remarks cited from Dr. Mitchell and the *Mémorial de Rouen* in a subsequent place, present the striking coincidence of death from meningeal or intra-cranial inflammation many days after the inhalation of ether, administered by incompetent persons, by way of sport. The mode of administration absolves the anæsthetic from any responsibility. It is not surprising that an intoxication, such as results from ether, should, especially in children, lead to a fatal issue in the manner described.

34. Mr. Payne, London, 1851. An inquest was held on the body of a man found dead in his bed. It appeared that the subject of this investigation had gone to his bed-room, saturated a towel with ether, which he was in the habit of breathing, got into bed and pulled the clothes over his head. The vapor overpowered him, and he was thus suffocated in the atmosphere of ether which he had created. The verdict was, "accidental death." (*Atlas* [Lond. newspaper], Nov. 22, 1851. Cited in *Am. Jour. Med. Sciences*, Vol. 23, p. 519.)

35. M. Velpeau, Paris, France. A female, aged 60 years, having had asthma for 7 or 8 years, breathed sulphuric ether for 20 minutes, and then underwent an operation for the removal of her breast, for a tumor as large as the fist. On the next day the patient was perfectly well; on the third, the respiration became labored, but without cough, the tongue was coated, her appetite disappeared, and there was intense thirst. Death took place in the evening.

At the autopsy the lungs were found engorged, and presented an appearance simulating pulmonary apoplexy. The bronchial mucous membrane was of a violet-red color. The heart and other organs were natural. (*De l'Ether Sulphurique*, par F. J. Lach, Paris, 1847.)

36. M. Roux, Paris, France. An abscess in the region of the hip was opened, after complete insensibility from sulphuric ether, in a man who for a long time had suffered from hip-disease, and was in a very exhausted state. During the rest of the day, he was sleepy, had vertigo, a bewildered expression and difficulty in his speech; he was with difficulty aroused, immediately falling back into the state of stupor. This semi-comatose state lasted three days, when the patient died.

At the autopsy, the membranes, and the brain itself, were found much injected. The lungs were congested, and there was general redness of the bronchial mucous membrane. The blood was fluid. (*De l'Ether Sulphurique*, par F. J. Lach, Paris, 1847.)

37. M. Roux, Paris, 1848. An old man, 82 years of age, breathed sulphuric ether, was cut for stone, and died. (*Des Effets physiologiques et thérapeutiques des Ethers*. II. Chambert, Paris, 1848.)

M. Chambert considers this case as a very doubtful one, and therefore gives no details.

38. M. Bergson, Berlin, 1847, refers to the case of an old man, said to have died in consequence of lithotripsy under ether. (*Die Medicinische Anwendung der Aetherdämpfe*. J. Bergson, Berlin, 1847.)

39. M. Velpeau, Paris, 1847. Excision of the tonsils under ether. Death from suffocation, by entrance of blood into the larynx. (*Ueber Aether Rausch*. E. Nathan, Hamburg, 1847.)

40. M. Scoutetten, Metz, France, refers to the case of a man, 50 years old, gradually sinking after an operation, and dying in four hours. (*Récherches sur les Anesthésiques en général*. L. Scoutetten, Metz, 1858.)

41. M. Giraldes, Paris, is reported to have said that he had, "not long since" (1861), witnessed a death from the inhalation of sulphuric ether. (*Dublin Medical Press*, June 5th, 1861.)

The following cases are noticed to complete the list of deaths alleged to have been in any way connected with the inhalation of ether.

Dr. A. March, Albany, N. Y., 1854. Operation for an enormous encephaloid tumor of the neck. The patient, a female, aged 18, breathed sulphuric ether for ten minutes, then half a drachm of pure, Paris chloroform, which had previously been used without detriment, and subsequently another half-drachm. In the course of the operation, the sternomastoid muscle was divided, and the common carotid artery and jugular vein, which passed through the tumor, were tied and cut off. Although no great amount of blood was lost, the operation was twice suspended in order to stimulate the patient with brandy. "Notwithstanding every effort was made to save the patient, still, the waning powers of life seemed to vibrate between hope and despair for near two hours, when she breathed her last without a struggle or even a distortion of the face."*****"By some it has been thought that the ether destroyed life, and by others that it was the chloroform. As to the former, I can say that the patient was not in the least rendered insensible by its use." (*Trans. of the Med. Society of the State of New York*, Albany, 1855.)

M. Legonest reports himself to have been a witness of a sudden death occurring in the practice of M. Valette, of Lyons, in 1858. The patient first inhaled sulphuric ether, and subsequently chloroform was added. (*L'Union Médicale*, March 15th, 1859.)

Dr. R. Crockett, Wytheville, Va., 1857. A boy, 5 years old, was operated on for a fatty tumor of the back, which required two incisions, nine inches long. He breathed a mixture of four parts of sulphuric ether and one of chloroform, and lost from four to six ounces of blood. When the operation was completed he began to vomit, and at the same time his pulse gave way; he died in three or four minutes from the commencement of vomiting. (*Am. Jour. of Med. Sciences*, Vol. 34, p. 284.)

A middle-aged female died from the inhalation of chloric ether in Lynn, Mass., in 1852-53. It was given for the extraction of a tooth, and death occurred before the operation was commenced. Nothing was found at the autopsy to account for the death. (*Committee's Correspondence*.)

Dr. Timothy Haynes, Hooksett, N. H., 1852. Operation for the removal of a tumor of the thigh. Concentrated chloric ether was administered. An unusually large amount, and great length of time, were required before the patient, a young girl, ceased struggling violently, but finally the operation was commenced, and almost at the same time the patient was found to be exceedingly prostrated, with both pulse and respiration failing. The tumor was removed, and the surgeon exerted himself to revive the child, but in vain. She died in from fifteen to twenty minutes. An ounce and a half of chloric ether was used. (*New Hampshire Journal of Medicine*, July, 1852, p. 307; *Boston Med. and Surg. Journal*, Vol. 47, p. 41.)

Dr. W. Ingalls, Chelsea Marine Hospital, 1852. A man, aged 20, breathed chloric ether for the evulsion of a toe-nail. On completing the operation, the patient looked pale, and the pulse was hardly perceptible. Efforts were immediately made to revive him, but were unavailing, and death took place. "From the first application of the sponge to the moment he ceased to breathe could not have been more than, if so much as, five minutes." Quantity used, two ounces and five drachms. The autopsy revealed nothing to explain the death. (*Boston Med. and Surg. Journal*, Vol. 46, p. 218.)

Dr. Foltz, of East Boston, Mass., 1852. Death during amputation of a finger, the patient being under the influence of a mixture of chloric ether and chloroform. (*Boston Medical and Surgical Journal*, August 18, 1852.)

A druggist's maid-servant was found dead in her bed, a three-gallon jar of *spiritus etheris nitrici* having been broken in her room dur-

ing the night previous. The room had no chimney, and the door had been kept shut. The reporter of the case, in the *London Medical Gazette*, says that this is the second instance of the kind which has come to his knowledge. (*Edinburgh Med. and Surg. Journal*, Vol. 35, p. 452; *London Medical Gazette*, Vol. 6, p. 87.)

The succeeding references are so indefinite as to possess scarcely any value, but are added simply for the sake of recognition as part of the existing evidence of the mortality resulting from the use of ether.

"Fatal effects of ether have become multiplied. In our last number one fatal case was noticed, occurring in the Edinburgh Royal Infirmary. We are informed that there are just now two other cases, in which ether was given, dying of secondary purulent deposits, in the same institution." (*Edinburgh Monthly Journal of Medical Science*, April, 1847.)

The December number of the same Journal says that it is now known that these deaths were "entirely owing to the imperfect apparatus and want of skill employed in the administration of the ether."

M. A. Trousseau (*Traité de Thérapeutique et de Matière Médicale*, 6me Ed., t. 2, p. 176) states that there have been 19 sudden deaths from ether. He says, in a letter to the Committee, "that it is impossible for him now to indicate the numerous and very authentic sources from which he derived his information, but most of the cases were obtained from French, German, English and American periodical literature."

Nine deaths from ether, collected towards the end of 1848, by a writer in the *Gazette Médicale de Lyon*, happened 3, 5, 8, 25, 34 hours, and 3, 6 and 15 days after the inhalation. They are considered by him as far from conclusive. (*Revue Médicale*, 31 Mai, 1859, p. 609.)

Three cases have been spoken of by correspondents of the Committee, viz., a midwifery case proving fatal after ether, supposed to be, in reality, from concealed hæmorrhage, and two others where many days intervened between the inhalation and the fatal result. The details of neither of them are obtainable.

MM. Levicaire and Long performed version under ether, in two cases of labor. Both mothers cry out, both fœtuses are dead. (*Ueber Æther Rausch*. E. Nathan, Hamburg, 1847.)

"Suffering from neuralgic pains, Madame Lafarge, liberated after the *affaire Glaudier*, made frequent use of coffee, ether and other liquid substances, the name of which escapes me now," says the editor of the *Gazette des Tribunaux*. "It appeared that the Sunday before her death the doses were considerably increased. In the evening,

some rather grave symptoms appeared, and in the night there seemed little prospect that she would live. At 9¼ on Monday morning she was dead." (*Mode d'Action des Anesthésiques par inspiration*. E. Robin, Paris, 1842.)

Dr. Mitchell, in his Chemistry (Philadelphia, p. 172) states, that at one time "a practice obtained amongst the lads of Philadelphia of inhaling ether by way of sport. In some instances the experiment excited mere playfulness and sprightly movements, but in several cases, delirium, and even phrenitis was induced, which ended fatally." It is also said that the same accident occurred in Rouen, France, two children having died from playing with ether. (*Mémorial de Rouen*, Feb. 3d, 1847; *Ueber Æther Rausch*. E. Nathan, Hamburg, 1847.)

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